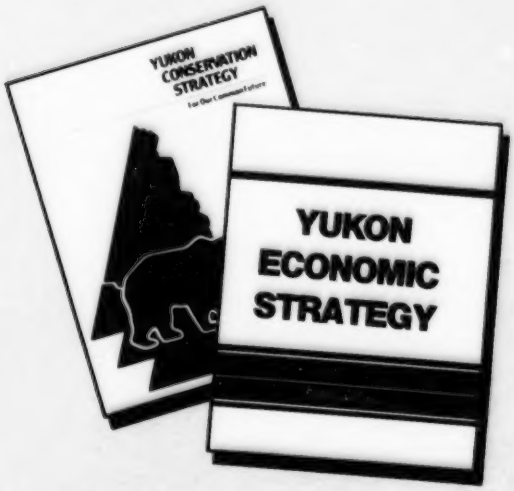
YUKON ENERGY STRATEGY

Electricity Development



Yukon
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YUKON ENERGY STRATEGY

ISSUE PAPER

ELECTRICITY DEVELOPMENT

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Summary

A wide variety of interrelated risks can be associated with electricity generation and distribution in the Yukon. These can be defined into five risk types: financial risks, electricity market risks, technological risks, environmental risks and social risks.

Risks associated with electrical generation can be borne by independent power producers, electricity customers or the taxpayers of the territory.

The absorption of risk and responsibility for electricity infrastructure by the Yukon Energy Corporation should only occur if the costs and risks are equitably distributed and are considered acceptable to those who are being asked to accept the risk.

It is important to understand the distribution of benefits, costs and risks associated with any infrastructure investment. The public should be informed of these risks, and their input included in the Yukon Energy Corporation's overall decision-making process.

ELECTRICITY DEVELOPMENT

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ELECTRICITY DEVELOPMENT

1. OVERVIEW

This is one of seven issue papers prepared as part of the Yukon Energy Strategy Framework. The Framework and seven issue papers have been distributed to Yukon people to help stimulate informed public involvement in the development of a Yukon Energy Strategy.

Economic growth and development in the Yukon will likely be accompanied by a need for increased electrical generating capacity and/or an expansion of the distribution infrastructure. As discussed in the Yukon Energy Strategy Framework document, it is in the best interest of the territory to ensure that present and future access to this generating capacity is secure. Therefore, the Yukon Government and the Yukon Energy Corporation (YEC) will have to provide some or all of the new electricity needed to meet this increased demand. In responding to this request, the Yukon Government and the YEC must take into consideration both the costs and the risks that are associated with any new investment. This paper examines the risks associated with this electrical infrastructure expansion, and discusses how these risks could be equitably distributed.

2 RISKS ASSOCIATED WITH ELECTRICITY GENERATION AND DISTRIBUTION

A variety of related risks are associated with electricity generation and distribution in the Yukon. These can be grouped according to five general risk types:

2.1 Financial Risks

These are risks associated with access to capital, or with the timing and size of expenditures. The risk associated with access to capital is best characterized by interest rates. Fluctuation in interest rates is a risk that affects all businesses worldwide. Risks associated with the timing or size of expenditures for electricity generating facilities can be significant.

2.2 Electricity Market Risks

Electricity market risks refer to the stability and predictability of long-term electricity sales. Long-term stability translates into low risk, while long-term uncertainty and the possibility of wide fluctuations in future sales is associated with higher risks. The electricity market in the Yukon is small and sparsely distributed. The small size of the market means that the loss or addition of a single large user can significantly affect the

overall electricity requirements in the territory. The distribution of this small market over a vast area increases the costs and amplifies the risk. For example, the Curragh mine requirements at Faro alone are expected to account for approximately 41 per cent of overall Yukon power generation requirements in 1992. When the Whitehorse Copper Mine and the Faro Mine closed in 1982,industrial power sales dropped by 70 per cent and total power needs were reduced by 35 per cent. At that time, an investment of $60 million into the construction of the Whitehorse #4 hydro facility was rendered redundant. In general, investments in major hydraulic generation facilities and related transmission facilities require large, up-front expenditures, and depend upon a long, steady stream of revenues to be financially viable.

2.3 Technological Risk

Any technology carries a risk of failure. Investment in new facilities must take this risk into account when forecasting anticipated performance or costs. In most cases, this risk is higher for newer technologies and lower for proven ones. Cost overruns in the construction and operation of facilities constitute a second category of technological risk. Unforeseen technical surprises may arise during or after construction, which generally results in increased costs. In most cases, these risks are higher for site-specific facilities, such as hydro plants and lower for "off-the-shelf" technologies such as diesel.

2.4 Environmental Risks

The generation of electricity in the Yukon is currently being supplied by a combination of hydro-electric stations and diesel generating units. Environmental risks are associated with both options. Large scale hydro development usually requires the creation of a storage reservoir which results in the flooding of terrestrial habitat and the disruption of the aquatic ecosystem. Diesel generation results in the emission of greenhouse gases and other toxic substances into the atmosphere. Transmission facilities can also have negative environmental impacts. For example, some evidence suggests that electro-magnetic fields, created by the current running along high voltage transmission lines, may cause health problems in humans.

Unlike financial or market risks, environmental risks are difficult to quantify and therefore difficult to compare to other risks. Attempts have been made to quantify environmental risks in economic terms by placing a monetary value on the threatened ecosystem component, but this has been only marginally successful. Instead, the evaluation of environmental risks is based largely upon a technical description of the risk, followed by a debate as to the value that society places upon the affected ecosystem component. Often, this value will differ from individual to individual and from group to group.

2.5 Social Risks

Investment in new generating capacity or new distribution infrastructure will have both positive and negative social effects on the territory. One positive effect would be the creation of employment opportunities, either directly, through construction and operation jobs, or indirectly through the supply of services needed for both construction and operation. Negative effects often arise in cases where economic growth occurs in the absence of community and social services, or when rapid economic growth is followed by an economic downturn when the construction phase of a development is completed. In addition, environmental impacts,such as those described above, will often affect the way in which society interacts with the environment. The clearest example of this would be environmental impacts that affect the traditional hunting and fishing economy of Yukon's native people.

A short discussion of a possible investment decision will demonstrate why these risks must be considered. The event is the servicing of a large new mine in the territory. Assume that the mine's electricity requirements are a considerable proportion of the YEC's total electricity capacity. Available options are to supply electricity from diesel or hydro. Selection of the diesel option is less expensive in the short-run since initial set-up costs are small, but the long-term costs are high because of the price of diesel fuel and the long-term environmental and health effects associated with diesel emissions. In contrast, the hydro option is more costly in the short-term due to the high financial cost of dam and infrastructure construction, as well as the high initial environmental disruption, but cheaper in the long-term because of the lower operating costs.

Risk exposure will depend upon the options selected. The hydro option exposes the YEC to significant market risks since this option requires long-term, steady sales to be profitable. If the mine were to close prematurely, the YEC would be left servicing a large debt with greatly reduced electricity sales. Alternatively, the diesel option exposes the YEC to far fewer risks because of the lower initial investment. However, if the mine remains open for a longer period of time, operating and environmental costs will accumulate. As with most investments, determination of which choice was "correct" cannot be made until well after the investment has been made.

3. WHO WILL ABSORB THESE RISKS

Risks associated with electrical generation can be borne by private investors, independent power producers, electricity customers or the taxpayers of the territory. The return on their investment will vary, and will depend in part on the risks described above. In most cases, higher risk investments are associated with higher potential returns, while more secure investments provide lower potential returns.

For example, when a private company wishes to expand, it will often turn to investors to capitalize its expansion. If the expansion is a risky one, the company will have to provide a higher rate of return in order to attract investors. If the expansion is less risky, the company could offer a lower rate of return and still attract the same amount of capital. Therefore, it is in the company's best interest to minimize risk. As more investors step forward, the risks are spread out over a larger number of individuals.
If a company's expansion in the Yukon requires the addition of electrical capacity or distribution infrastructure, the company's investment becomes exposed to the risks described above. Since it is in a company's best economic interest to minimize the risk of its expansion, it will attempt to transfer this risk to whomever will accept it. If electricity is provided by an independent power producer (IPP), a portion of the risk is transferred from the company's investors to the IPP investors. If instead, the risk is accepted by the Yukon Energy Corporation or the Yukon Government, this risk becomes absorbed not by private investors, but by electricity ratepayers or Yukon taxpayers.

As a crown corporation, the Yukon Energy Corporation is owned by the taxpayers of the territory, and its risks ultimately become the taxpayers' responsibility. However, since the YEC operates as a self-financing entity the financing of its debt, and the risk associated with that debt, are shouldered not by taxpayers but by the Yukon's electricity ratepayers. Given the fact that the majority of Yukon taxpayers are also electricity ratepayers, this does not significantly change the number of people affected by the risk, but it can affect the way in which those risks are distributed.

Since taxpayers and ratepayers are potentially responsible for much of the risks associated with electricity development, it is important that opportunities for public input exist. As taxpayers, one effective method is through political elections. In addition, letters to elected representatives or representation before legislative committees can also allow for public input. Decisions affecting environmental risks can be influenced by way of the Federal Environmental Assessment Review Process (EARP) or by lobbying directly to government through environmental groups. Ratepayers can make representations before the Yukon Utilities Board (YUB) regarding any proposed increase in electricity rates. These rates will reflect, in part, the cost of added risk to electricity customers. In making their decisions, the YUB, environmental assessment review panels and government officials must consider the way risks are distributed, and use public input to determine an acceptable level of risk for their constituents.

4. TYPES OF INVESTORS AND THE MANAGEMENT OF RISK

Individual investors will differ in the way that they approach risk. Some are risk takers who actively seek out risky situations since these are often associated with significant potential returns. Others can be considered risk-averse, and will gladly forego the

opportunity to invest in a risky venture in favour of a lower, but guaranteed rate of return. In general, private investors are more apt to be risk takers, while governments and crown corporations (who are acting on behalf of taxpayers and electricity ratepayers) tend to be more conservative and wary of risk.

Risk management can be viewed as a two-step process. The first step involves minimizing risk as much as possible. This is usually accomplished by gathering information to reduce uncertainty. Once risk has been minimized, the risk can be further managed by distributing the risk through insurance or diversification. Insurance involves spreading the risk externally over a larger number of individuals, trading a large but uncertain risk for a smaller but certain premium payment. Diversification is an internal organization of an investment portfolio such that high risk investments are balanced by more secure investments. The balance chosen between high and low risk investments will reflect the manner in which the investor approaches risk. A risk-taking investor may have 50 per cent of their portfolio in high risk investments, while a risk-averse investor may have only five per cent in high risk investments. If the high risk investments were to fail, the impact on the overall portfolio is reduced according to the percentage given to lower risk investments. By the same token, any gains are similarly reduced.

It is important to note that in some cases the dollar value of a risk can be estimated and paid up-front (as is the case with insurance premiums), whereas in other cases this calculation is not possible before the event occurs. In this latter case, risk management largely involves preparation before the event and paying after the event has occurred.

5. THE DISTRIBUTION OF RISK FOR ELECTRICAL ENERGY DEVELOPMENT

In a situation where a potential energy user requires a significant amount of new electrical capacity and distribution infrastructure, the costs and risks associated with this new infrastructure can be distributed over the following groups: private investors (including IPPs), electricity ratepayers, and taxpayers. Each of these groups has been previously described in section 3.0. This distribution can occur in four general ways:

. Private Investors or Independent Power Producers Pay

All incremental costs and risks for increased capacity and distribution infrastructure are borne either by the customer requesting the new capacity, or by an independent power producer.

- **YEC (electricity ratepayers) and Private Investors Pay**

The costs and risks are shared between the YEC and the customer requesting the new capacity. This could be arranged either through a cost-share agreement in which both the new user and the YEC make a direct investment into the new infrastructure, or in the form of a loan to the customer that is held by the YEC.

- **YEC (Electricity Customers) Pay**

YEC bears all costs and risks, and passes these costs on to the distribution utility and ultimately to all customers. Within this option, costs and risks can be distributed equally to all customers or differentially to certain classes of electricity users.

- **YTG (Taxpayers) Pay**

The Yukon Government bears all cost and risks, either by investing directly in the new capacity, or by guaranteeing loans to complete the construction.

6. EVALUATION OF RISK DISTRIBUTION OPTIONS

An evaluation of these four options must consider the notions of equity and acceptability. Equity is a relative term that implies that the costs and risks associated with an investment are distributed such that those who benefit from the investment also accept their fair share of the costs and risks. It is something that is theoretically quantifiable. Acceptability is a more absolute term that refers to the maximum cost and level of risk that an individual or group is willing to accept. Quantification is very difficult since the factors affecting acceptability will vary with each individual or situation. With this in mind, we shall attempt to identify the positive and negative aspects of each option. Bear in mind that the selection of a "best option" will be specific to each situation.

6.1 Private Investors Pay

Under this option, all of the costs and risks are absorbed either by the company that initiated the need for the expansion, or by an independent power producer. This option approximates an equitable distribution if the majority of the benefits accrue exclusively to the new company. This is more likely to be the case when a company is located in an isolated corner of the territory. An example is the Sa Dena Hes Mine in Watson Lake, where electricity is provided by Curragh Resources own diesel generators. Since this option does not involve either the taxpayers or the ratepayers of the Yukon, determining acceptability would not be a difficult exercise.

6.2 Taxpayer Pays

The "Taxpayer Pays" option places the entire cost and risk for infrastructure expansion on the shoulders of the people of the Yukon. In an effort to attract an investor to the Yukon, the government may decide that the benefits to Yukon people in the form of employment, supply of services, and increased tax revenue, are greater than the costs and risks associated with the provision of electrical infrastructure. Equity is achieved if the government's investment is offset by these benefits to Yukon people. Acceptability would depend upon the overall size of the investment, the level of risk associated with it, and public opinion as to whether expected benefits warrant the cost and the risks.

6.3 YEC Customers Pay

This option distributes risk over the electricity users rather than the entire population. Although for the most part, the two populations are the same, the manner in which the distribution occurs is more directly relevant to electricity use. Contracts for energy pricing are routinely negotiated between the YEC and large energy users. These contracts should take into account not only the marginal cost of supplying electricity to the new user, but also an equitable proportion of the risk associated with any necessary expansion. Benefits will also accrue to other current and future users of the system, either through an overall expansion of capacity, or though more localized improvements necessary to service the new user. In order to maintain equity, costs and risks should also fall to these additional beneficiaries.

Any distribution of costs and risks beyond the new user's contract would have to be requested through the Yukon Utilities Board. The acceptability of any additional cost and risk to current ratepayers would be tested in this public forum. Therefore risk and the acceptability of that risk, would have to be taken into consideration by Board members before making a final decision.

6.4 YEC and New User Pays

This option shares the costs and risks between the company and the Yukon Energy Corporation. If risks are distributed by way of a loan to the new user that is either held or guaranteed by the YEC, the corporation has absorbed mostly risk and potential future costs, and has minimized its absorption of immediate costs. If on the other hand, a cost sharing agreement is negotiated between the new user and the YEC, immediate costs are borne by the corporation, and approval would have to be gained from the Yukon Utilities Board to pass this increased cost on to electricity customers. Although it is not unusual for electrical utilities to share the cost of transmission facilities required to connect a new user to the grid, new generating capacity is generally the responsibility of the utility.

7. CONCLUSION

The absorption of risk and responsibility for electricity infrastructure by the YEC should occur only if the costs and risks are equitably distributed and are considered acceptable to those who are being asked to accept the risk. To assist in this determination, it is important to understand the distribution of benefits, costs and risks associated with any infrastructure investment. This information must be communicated to the public through consultation. The results of this consultation should then be included as an important component of the YEC's overall decision-making process.